GE Energy

David H. Hinds
Manager, ESBWR

PO Box 780 M/C L60
Wilmington, NC 28402-0780
USA

T 910 675 6363
F 910 362 6363
david.hinds@ge.com

MFN 06-245

Docket No. 52-010

August 7, 2006

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application – Engineered Safety Features – RAI Numbers 6.3-4, 6.3-9, 6.3-26 through 6.3-29, 6.3-30 and 6.3-32**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

D068

Reference:

1. MFN 06-198, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application,* June 22, 2006

Enclosure:

1. MFN 06-245 – Response to Portion of NRC Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application – Engineered Safety Features – RAI Numbers 6.3-4, 6.3-9, 6.3-26 through 6.3-29, 6.3-30 and 6.3-32

cc:

WD Beckner	USNRC (w/o enclosures)
AE Cubbage	USNRC (with enclosures)
LA Dudes	USNRC (w/o enclosures)
GB Stramback	GE/San Jose (with enclosures)
eDRFs	0056-0795, 0056-2420, 0056-5058, 0056-2899

ENCLOSURE 1

MFN 06-245

Response to Portion of NRC Request for

Additional Information Letter No. 34

Related to ESBWR Design Certification Application

Engineered Safety Features

RAI Numbers 6.3-4, 6.3-9, 6.3-26 through 6.3-29,

6.3-30 and 6.3-32

NRC RAI 6.3-4

Even though some of the design basis parameters for GDCS are given in Table 6.3-2, it is not complete. Provide a diagram showing the GDCS design and operating parameters: pressure, temperature and flow rates. Submit the GE standard process diagram.

GE Response

Comment accepted. A process flow diagram for the GDCS will be provided by September 29, 2006.

NRC RAI 6.3-9

Since the SLCS system is part of the ESBWR ECCS, the likelihood of inadvertent SLCS actuation during normal plant operation may be increased. Discuss measures to prevent inadvertent operation of SLCS, and discuss any potential safety consequences with inadvertent SLCS operation.

GE Response

The SLCS start signal is received from the ECCS trip signal logic as described in DCD Tier 2 Subsection 7.3.1.1.2. Each division of the ECCS has two channels of 2-out-of-4 trip logic to support the requirement that a single divisional failure does not inadvertently open any squib valve in the SLCS. This feature minimizes the likelihood of inadvertent SLCS actuation during normal plant operation. This is the same logic that is being used for operating plants with squib valves in this application. To date there have been no inadvertent actuations during power operation.

The consequence of an inadvertent actuation of the SLCS is the same as a deliberate actuation. The reactor would be brought safely to a shutdown condition as designed. Unlike an inadvertent scram however, this event would have an adverse impact on plant availability due to the potential for extended outage time to cleanup and remove the sodium pentaborate from the reactor and connected systems.

No DCD changes will be made in response to this RAI.

NRC RAI 6.3-26

DCD Tier 1, ITAAC Table 2.1.2-2, Nuclear Boiler System

Item # 12 ADS Logic should be similar to the ABWR ITAAC. Add the acceptance criteria similar to item # 12 of the ABWR Nuclear Boiler System ITAAC for each timer in the ECCS.

Add the following ECCS Timer values given DCD Tier 2, Table 6.3-1, "Significant Input Variables to the ECCS-LOCA Performance Analysis":

(a) Time delay to confirm ECCS-LOCA signal: 10 secs

(b) Time after LOCA confirmed initiating before signaling Group 2 ADS to open: 10 seconds

(c) ADS time delay before Group 1 DPVs open: 50 seconds

(d) ADS time delay before Group 2 DPVs open: 50 seconds

(e) ADS time delay before Group 3 DPVs open: 50 seconds

(f) ADS time delay after Group 3 initiation, before Group 4 DPVs open: 50 seconds

(g) Injection squib valve time delay: 150 seconds

(h) Equalization squib valve time delay: 30 minutes

(I) Manual equalization squib valve initiation logic time delay: 30 minutes

(j) ECCS initiation time delay for Level 1.5 initiation: 15 minutes

GE Response

GE will revise item #12 in DCD Tier 1 ITAAC Table 2.1.2-2 to make it similar to the ABWR ITAAC and add the acceptance criteria for each timer in the ECCS.

Item #12 in DCD Table 2.1.2-2 will be revised in the next update as noted in the attached markup.

NRC RAI 6.3-27

DCD Tier 1, ITAAC Table 2.1.2-2, Nuclear Boiler System

Item # 10: The opening times for the SRV are 1.7 seconds and 0.3 seconds for ESBWR and ABWR respectively. Confirm that this value is correct. If so, explain why the SRV opening time for the ESBWR is higher?

GE Response

The SRV opening time of 1.7 seconds is correct for the ESBWR design. The overpressure protection system, which consists of the SRVs, is capable of accommodating the most severe pressurization transient. The ESBWR pressurization is mild relative to previous BWR designs and the ABWR design because of the large steam volume in the chimney and vessel head of the ESBWR design. This mitigates the pressurization, which means that slower SRV opening times are acceptable.

No DCD changes will be made in response to this RAI.

NRC RAI 6.3-28

DCD Tier 1, ITAAC Table 2.1.2-2, Nuclear Boiler System

Item # 12: Change "The SRV flow capacities are given in Table 2.1.2-1" to "The SRV and DPV flow capacities are given in Table 2.1.2-1". Table 2.1.2-1 provides both SRV and DPV flow capacities.

GE Response

According to the subject of the RAI, the RAI should be referring to Item # 10 instead of Item # 12. DPV flow capacity is addressed in Item # 16 of Table 2.1.2-2. Because Table 2.1.2-1 includes DPV flow capacity, GE will add text in item # 16 to refer to Table 2.1.2-1.

DCD Tier 1 ITAAC Table 2.1.2-2 will be revised in the next update as noted in the attached markup.

NRC RAI 6.3-29

DCD Ter 1, ITAAC Table 2.1.2-2, Nuclear Boiler System

Include the SRV Control from Remote Shutdown Panel.

GE Response

GE will add new item # 27 in DCD Tier 1 ITAAC Table 2.1.2-2 to address SRV control from the Remote Shutdown Panel.

DCD Tier 1 ITAAC Table 2.1.2-2 will be revised in the next update as noted in the attached markup.

Table 2.1.2-2

ITAAC For The Nuclear Boiler System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
12. Upon receipt of an ADS initiation signal, the ADS logic generates signals to the ECCS components.	12. Tests will be conducted using simulated input signals for each NBS process variable to cause trip conditions in the instrument channels of the same process variable associated with each of the ADS logic divisions.	12. a. Upon receipt of ~~an~~ a low water level signal, concurrent with a high drywell pressure signal, at the input to the ADS initiation ~~signal~~logic, the ~~ADS logic generates signals to the SRVs and the DPVs.~~following occurs: (1) The Confirm ECCS-LOCA Signal timer initiates and continues to time out in the continued presence of the RPV low water level signal. The time delay is less than or equal to 10 seconds. (2) Upon time out of the Confirm ECCS-LOCA Signal timer, an actuation signal is generated to the Group 1 ADS SRVs and the Group 2 ADS timer initiates and continues to time out. Upon time out, an actuation signal is generated to the Group 2 ADS SRVs. The time delay is less than or equal to 10 seconds.

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		(3) Upon time out of the Confirm ECCS-LOCA Signal timer, the Group 1 DPV timer initiates and continues to time out. Upon time out, an actuation signal is generated to the Group 1 DPVs. The time delay is less than or equal to 50 seconds. (4) Upon time out of the Confirm ECCS-LOCA Signal timer, the Group 2 DPV timer initiates and continues to time out. Upon time out, an actuation signal is generated to the Group 2 DPVs. The time delay is less than or equal to 100 seconds. (5) Upon time out of the Confirm ECCS-LOCA Signal timer, the Group 3 DPV timer initiates and continues to time out. Upon time out, an actuation signal is generated to the Group 3 DPVs. The time delay is less than or equal to 150 seconds. (6) Upon time out of the Confirm ECCS-LOCA Signal timer, the Group 4 DPV timer initiates and continues to time out. Upon time out, an actuation signal

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		is generated to the Group 4 DPVs. The time delay is less than or equal to 200 seconds. (7) Upon time out of the Confirm ECCS-LOCA Signal timer, the GDCS Injection Squib Valve timer initiates and continues to time out. The time delay is less than or equal to 150 seconds. (8) Upon time out of the Confirm ECCS-LOCA Signal timer, the GDCS Equalization Line Squib Valve timer initiates and continues to time out. The time delay is less than or equal to 30 minutes. (9) Upon manual actuation of the GDCS Equalization Line Squib Valve initiation logic, concurrent with an RPV low-pressure signal, the GDCS Manual Equalization Line Squib Valve timer initiates and continues to time out. The time delay is less than or equal to 30 minutes. b. Upon receipt of a low water level signal, in the absence of a high drywell

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		pressure signal, at the input to the ADS initiation logic, the following occurs: (1) The Delay Timer initiates. The time delay is less than or equal to 15 minutes. (2) Upon time out of the Delay Timer, concurrent with an RPV low water level signal, the Confirm ECCS-LOCA Signal timer initiates and continues to time out in the continued presence of the RPV low water level signal. The time delay is less than or equal to 10 seconds. The remaining sequence and criteria are the same as described above in 12.a (2) through 12.a (9).

Table 2.1.2-2

ITAAC For The Nuclear Boiler System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
16. The DPV minimum flow capacity is 239 kg/s (1.897 Mlb/hr) as shown in Table 2.1.2-1.	16. Analyses and tests (at a test facility) will be performed.	16. Test reports and analyses exist and conclude that the DPV flow capacity is greater than or equal to 239 kg/s (1.897 Mlb/hr) as shown in Table 2.1.2-1.

Table 2.1.2-2

ITAAC For The Nuclear Boiler System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
27. Remote Shutdown System displays and controls are provided for the NBS SRVs and RPV level and pressure.	27. Inspections will be performed on the RSS displays and controls for the NBS.	27. Displays and controls exist on the RSS for the NBS SRVs and RPV level and pressure.

NRC RAI 6.3-30

DCD Tier 2, Table 1A-1, addresses TMI-2 action item III.D.1.1 with respect to provisions for leakage control and detection in the design of systems outside containment that contain (or might contain) accident source term radioactive materials following an accident. The table lists seven systems that could contain radioactive material outside the primary containment. Please explain why SLCS was not included in this list.

GE Response

Inboard and outboard check valves on the SLCS injection lines provide the primary means for containment isolation to prevent radioactive material from entering the system outside primary containment. These valves are subject to periodic leakage testing to confirm their function.

Additionally, the operating characteristics of the SLCS will prevent the introduction of radioactive material from the reactor into the system. During normal plant operation, the SLCS is in a standby condition filled with sodium pentaborate solution and maintained at a pressure greater than that of the reactor and is isolated from the reactor by the squib valves that provide a leak-proof barrier

Following an accident in which the SLCS is actuated, the system will inject solution into the reactor until isolated by a low accumulator level signal. At this time, the system is still filled with sodium pentaborate at a pressure greater than the reactor. This prevents the back leakage of radioactive material from the reactor into the SLCS outside containment.

For these reasons the SLCS is not listed in DCD Tier 2, Table 1A-1 as a system that could contain radioactive material outside the primary containment.

No DCD changes will be made in response to this RAI.

NRC RAI 6.3-32

What limitations, if any, will be placed on the ECCS cumulative outage times, i.e., unavailability due to frequent outages, but within the allowable outage times in the technical specifications?

GE Response

ECCS cumulative outage times will be addressed through the implementation of the Maintenance Rule. 10 CFR 50.65, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants, (the Maintenance Rule) requires each licensee to monitor the performance or condition of structures, systems, and components (SSC), which includes the safety-related ECCS SSCs, against licensee-established goals to ensure that the SSCs are capable of fulfilling their intended functions. The performance and condition monitoring activities required by 10 CFR 50.65 (a)(1) and (a)(2) will identify if poor maintenance practices result in multiple entries into the actions of the Technical Specifications and unacceptable unavailability of these SSCs and ensure appropriate corrective actions when the performance of an SSC does not meet established goals. 10 CFR 50.65 (a)(3) requires that the effectiveness of these performance monitoring activities, and associated corrective actions, are evaluated at least every refueling cycle, not to exceed 24 months. Additionally, under 10 CFR 50.65(a)(4), the risk impact of all inoperable risk-significant equipment must be assessed and managed when performing maintenance activities (including but not limited to surveillance, post-maintenance testing, and corrective and preventive maintenance).

The Advisory Committee on Reactor Safeguards (ACRS) evaluated the need to implement a limit on cumulative outage time (COT) during the evaluation of Generic Safety Issue (GSI) B-61, "Allowable ECCS Equipment Outage Periods." As documented in a letter from Dana A. Powers, ACRS Chairman, to Dr. William D. Travers, NRC Executive Director for Operations, dated February 19, 1999; the ACRS concluded that issues identified under GSI B-61 will be addressed through the implementation of the Maintenance Rule because ECCS COT during unscheduled or corrective maintenance did not meet the substantial added protection criterion specified in the regulatory analysis guidelines.

For the ESBWR, development and implementation of programs required by Maintenance Rule are the responsibility of each Combined Operating License (COL) applicant/holder and no further action is required during the ESBWR design certification process.